Electro-optical Absolute Encoders
CRD/S3 series with SIL2 certificate
MULTITURN ▫ PROFIsafe Interface

CRD 12098 GE

04 / 2011

- **Compact and robust design for mechanical engineering and industrial plant applications**
- **PNO Profisafe Certificate No. Z20020**
- **SIL2 according to TÜV certificate Nr. 44 799 11 391019-001**
- **With PROFIsafe Interface to *PROFIsafe-Profile for Safety Technology, Version 1.30, No. 3.092/ Version 2.00, No.3.192 (PNO)***
- **DP-Slave Class 2 functionality in accordance with *Profibus-Profile for Encoder, No. 3.060 (PNO)***
- **Total number of positions: 2^{25} (25 bits) max.**
- **With Velocity signal depending on rotation sense, gating time adjustable**
- **SIL2 Certificate in preparation**
- **Operating speed up to 2500 min^{-1}**
- **Optonal: Flange, housing and connecting cap in stainless steel - series "SRD"**

- **Protection grade IP 65 or IP 66**
- **Diagnosis LED's for supply voltage, SRD, Class 2 and Error**

General description

The encoder CRD/S3 has been designed according to the PROFIsafe profile for safety technology to the PNO standards No. 3.092/ 3.192 (PNO). The protocol meets the DP slave class 2 functionality to PNO No. 3.060 and is described in the TWK user manual no. CRD 12099.

In addition to the angle position a velocity measurement signal is generated via the position data. The gating time of the velocity measurement is adjustable in the range of 1...255 ms.

The PROFIsafe-Profile has been developed for safety relevant applications where human lives and environmental objects may be exposed to danger. In case of any unexpected event the device should revert to a fail-safe operation. To comply with this requirement the model CRS/S3 encoders feature additional surveillance functions which are described in the manual no. CRD 12099.

The SPC3 Siemens PROFIBUS controller has been implemented at the output interface. The maximum data transmission rate is 12 MBaud.

To guaranty a fail safe operation, a fail safe master, e.g. Siemens F-CPU with S7 Distributed Safety must be used.

Because of different parameter and diagnosis data the CRD/S3 ist not compatible to the preceding model CRD/S2.

Construction

Flange and housing of aluminium - respectiny stainless steel for SRD series - 12 mm ball-bearings with Nilos ring seal or radial packing ring seal - code disk of glass or of deformation resistant plastic - GaAlAs diodes - photo-transistor array with comparator and trigger circuits for long-term stabilization of the sensor systems gate array - SMD technology - additional implementations for safety functions to comply with SIL2 to IEC 61508.

Connecting cap

T-coupler functionality with integrated addressing code

Connection leads and functions:

- ▫ 1 cable for the supply voltage (+ V_S = 24 VDC, - V_S = 0 VDC), M12 cable gland
- ▫ 1 cable for Bus in (A, B), M16 cable gland
- ▫ 1 cable for Bus out (A', B'), M16 cable gland
- ▫ The station address and bus-termination resistors are set with DIP switches in the connecting cap.

TWK-ELEKTRONIK GmbH · PB. 10 50 63 · D-40041 Düsseldorf · Tel.: +49/211/63 20 67 · Fax: +49/211/63 77 05 · info@twk.de · www.twk.de

Electrical data

- Sensor system: GaAlAs diodes, photo-transistor array
- Resolution (max.): 8192 positions per revolution
- Measuring range: 4096 revolutions
- Total number of positions: 2^{25} (25 bits max.)
- Graduation code: Gray
- Max. position variance: ≤ ± 2‘ 38“ at 4096 positions/rev.
  ≤ ± 1‘59 at 8192 positions/rev.
- Output code: Natural binary
- Velocity signal: depending on rotation sense, 16 bit, unit: steps/gating time (the gating time is programmable in the range of 1 to 255 ms, default: 10 ms)
- Code sense: CW or CCW; (programmable)
- Supply voltage range: + 13,5 VDC to + 30 VDC
- Power consumption: P_D ≤ 3,5 W (Inrush current ≤ 300 mA)
- Interface: Line driver in acc. with RS 485; galvanic separation is achieved with an opto-coupler. Supply voltage galvanic separation is achieved with DC/DC-converter
- Electromagnetic compatibility (EMC): EN 61000-4-2 (ESD)
  EN 61000-4-4 (Burst)
  EN 61000-6-4 (Emission)

Bus data

- Specification: PROFIsafe-Profile for Safety Technology (No. 3.092/ 3.192 - PNO)
  Profibus-Profile for Encoder (No. 3.060 - PNO)
- Data transmission rate: 9,6 kBaud to 12 MBaud
- Manufacturer code: 1962h
- Stations address: 1 to 126
  Default value: 123
  adjustable via DIP switches
- GSD File: in acc. with DIN 19245-3, PROFIBUS-DP
- Diagnosis LED's*: U_B (green) - Supply voltage
  SRD (green) - SRD
  C (green) - Class
  Err (red) - Error
- Freeze mode: not supported
- Sync mode: not supported
- Automatic baud rate search: being supported
- Diagnosis bytes Class 2: 66 Diagnosis bytes
- User-Parameterbytes Class 2: 45 Bytes
- Configuration options: PROFIsafe, Class 2 -Encoder

* True table according to the connector arrangement will be supplied with each item.

Safety Data (IEC61508)

- According to IEC 61508:
  - PFH = 4,35 x 10^{-7} 1/h
  - SFF = 98 %
  - HFT = 0
  - SIL2
- According to EN ISO 13849-1:
  - $MTTF_D$ > 100 years
  - DC = 98 %
  - Category 2
  - Performance Level D

Mechanical data

- Operating speed: 2500 min^{-1} max
- Angular acceleration: 10^5 rad/s² max.
- Moment of inertia (rotor): 45 gcm²
- Operating torque: ≤ 5 Ncm (8 Ncm - CRD66) (at 1000 rpm)
- Starting torque: ≤ 1 Ncm (4 Ncm - CRD66)
- Permissible shaft load: 250 N max. (axial and radial)
- Bearing life expectancy: 10^9 revolutions *
- Mass
  CRD 58, 65 and 66: ca. 0.7 kg with connecting cap
  CRD 105: ca. 1.4 kg with connecting cap

* At max. shaft load and working temperature between - 20 °C and + 60 °C. Higher values are permissible with lower loads.

Environmental data

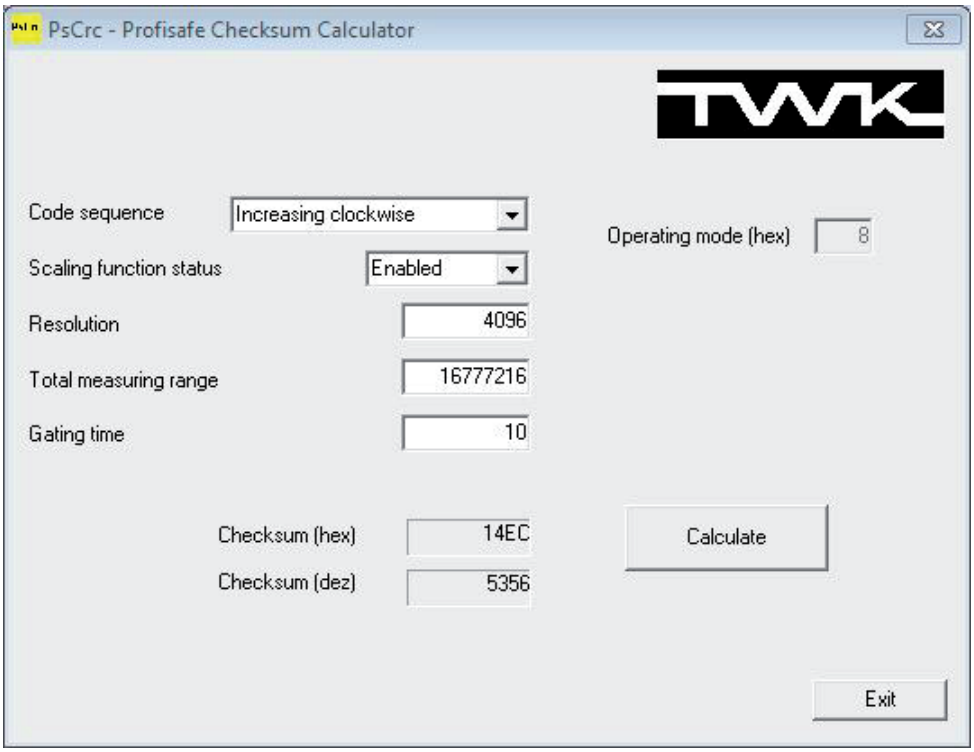
- Operating temperature range: - 20 °C to + 60 °C
- Storage temperature range: - 20 °C to + 60 °C
- Permissible rel. humidity: 85 % without condensation
- Resistance to shock: 200 m/s²; 6 ms (DIN IEC 68)
- Resistance to vibration: 5 Hz to 2000 Hz; 100 m/s² (DIN IEC 68)
- Protection grade (DIN 40 050)
  - CRD 58, 65 and 105: IP 65 (Nilos ring)
  - CRD 66: IP 66 (radial packing ring)
  - Connecting cap: IP 00 (when not mounted)

Programming parameter: Encoder

Parameter	Range of values	Parameter description
Code sense	CW, CCW	Direction of rotation when looking towards the shaft: CW (clockwise), CCW (counter clockwise)
Scaling function	disable, enable	Enable for programming the parameters *Resolution and Total number of positions* and of the preset function
Resolution	2 to 8192 Positions/360°	Number of positions per revolution
Total number of positions	2 to 33.554.432	Total number of positions in steps (Total number of positions = resolution x number of turns)
Gating time	1 to 255 ms	Time intervall for the counting of steps of the speed measurement
Standard Parameter CRC	1 to FFFF	CRC-Checksum of standard parameters
Reference value (by data exchange)	0 to (Total number of positions -1)	Value displayed at the reference point

Programme for calculating the CRC checksum via the standard parameters

After changing an encoder parameter, the CRC checksum has to be re-calculated and entered in the "Standard Parameter CRC" parameter. The programme PsCrc.exe is enclosed on CD-ROM on delivery for calculating the CRC checksum.



Programming parameter: F-Parameter

Parameter	Range of values	Default	Parameter description
F_Check_SeqNr	0: NoCheck	NoCheck	This parameter defines whether or not the consecutive number shall be included in the CRC2 signature.
F_Check_iPar	0: NoCheck	NoCheck	This parameter defines whether or not the checksum of the individual parameters CRC3 shall be included in the CRC2 signature.
F_SIL	01b: SIL2	SIL2	SIL2 (Safety Integrity Level) to IEC 61508 (Functional safety of electrical/ electronic/programmable electronic safety-related systems)
F_CRC_Length	00b: 3-Byte-CRC (V2-Mode) 01b: 2-Byte-CRC (V1-Mode) 10b: 4-Byte-CRC (optional V1/ V2 Mode)	2-Byte-CRC	CRC Test value (of F- useful data)
F_Block_ID	No F_iPar_CRC	No F_iPar_CRC	fix adjusted
F_Par_Version	00b: V1-mode 01b: V2-mode	V1-mode	Parameter version
F_Source_Add	1-65534	2001	This parameter is allocated through the SIMATIC manager automatically.
F_Dest_Add	1-65534	123	This parameter must agree with the address in the connecting cap.
F_WD_Time	1-65536 ms	2000	A valid current Safety telegram from the F-CPU must come inside the watchdog time.
F_ParCRC (CRC1)	0-65535		CRC-Sum of the F-Parameter from F_Prm_Flag1

Data format

Output data: Host to slave

Octet 1	Octet 2	Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8	Octet 9	Octet 10
MSB *	Preset value		LSB	MSB	Dummy	LSB	F-Data		

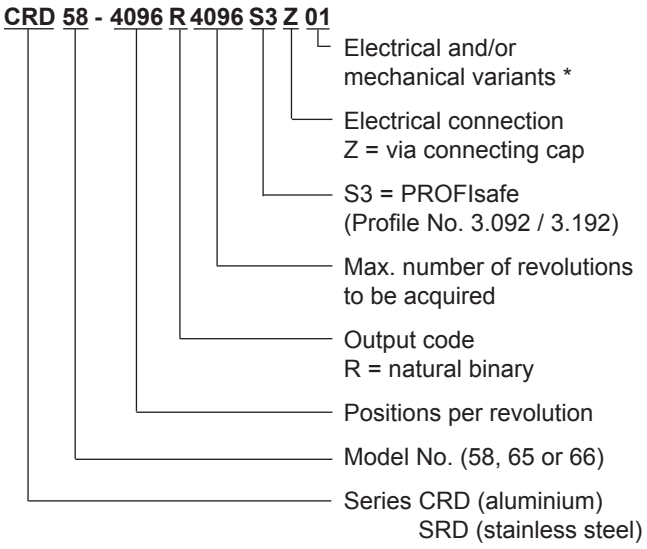
* Preset control: Bit 31: 1/O

Input data: Slave to host

Octet 1	Octet 2	Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8	Octet 9	Octet 10
MSB	Position value		LSB	MSB	Velociity	LSB	F-Data		

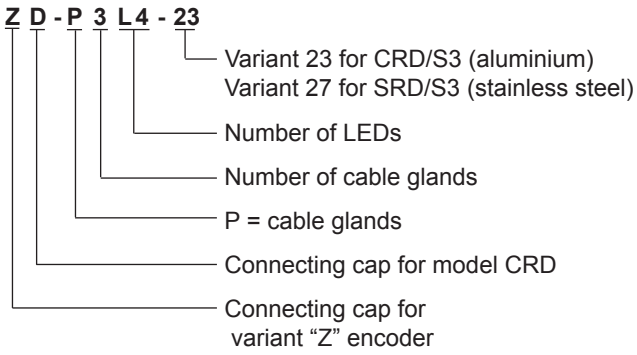
Order code

Order code format encoder



* The basic versions in accordance with the data sheet bear the code number 01. Variations from the basic version are indicated with a consecutive number and are documented in our works.

Order code format for connecting cap



Scope of delivery

- CD-ROM with profisafe user manual CRD 12099, GSD file and the PsCrc programme for calculating the CRC checksum for the standard parameters.
- **STD25WS17** mating connector for the heating in design form 105.

Accessories (to be ordered separately)

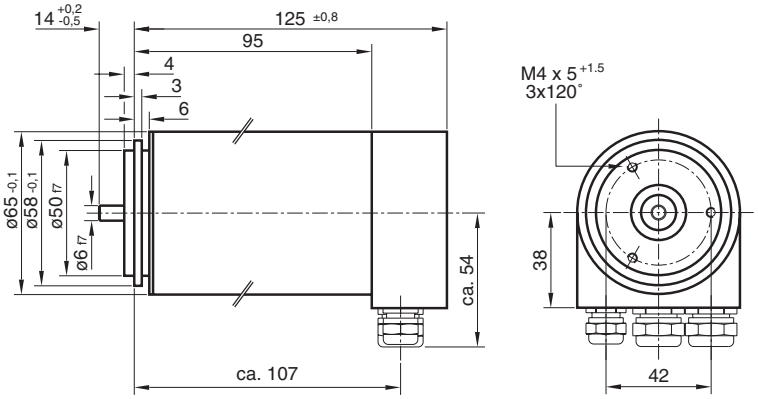
- Installation accessories according to data sheet MZ 10111

Documentation

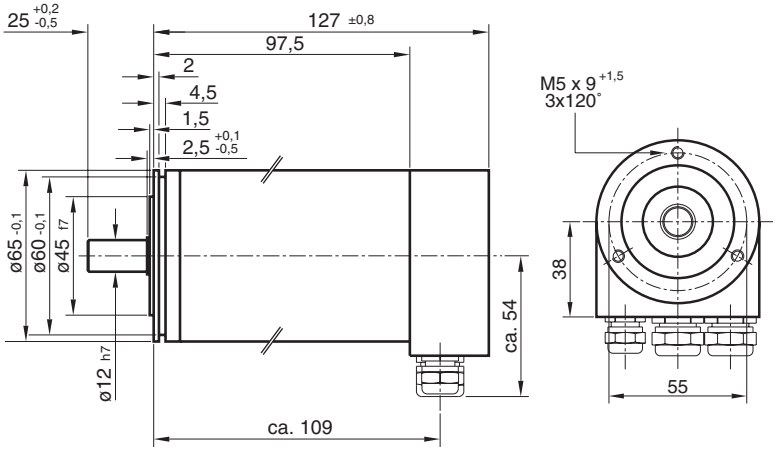
- Relevant profisafe user manual CRD 12099
- The connection assignment enclosed with the device
- The TZY10206 installation instructions enclosed with the device
- Procurement source for the PNO specifications: PROFIBUS Nutzerorganisation e. V., Haid-und-Neu-Str. 7, D-76131 Karlsruhe www.profibus.com

Dimensions in mm

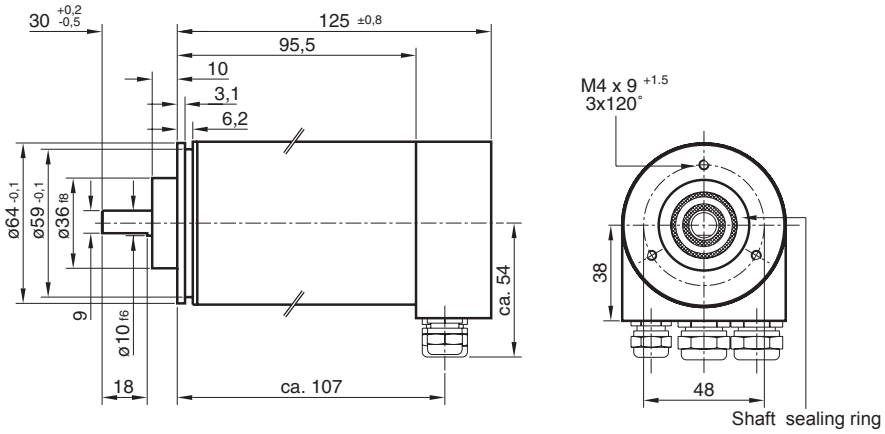
Model No. 58 with synchro-flange



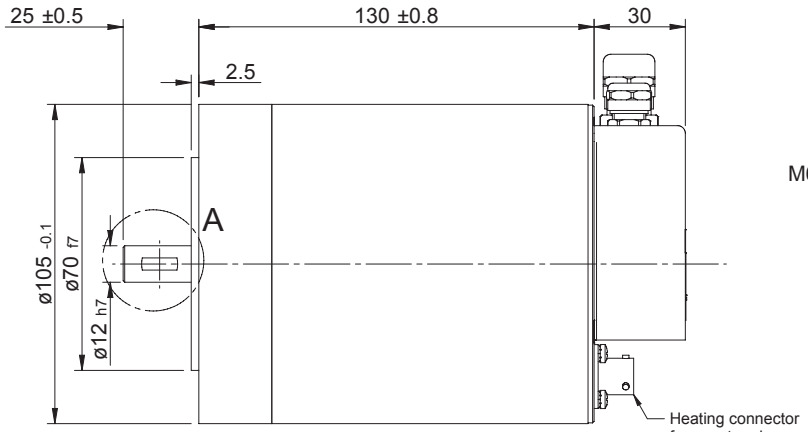
Model No. 65 with synchro-flange

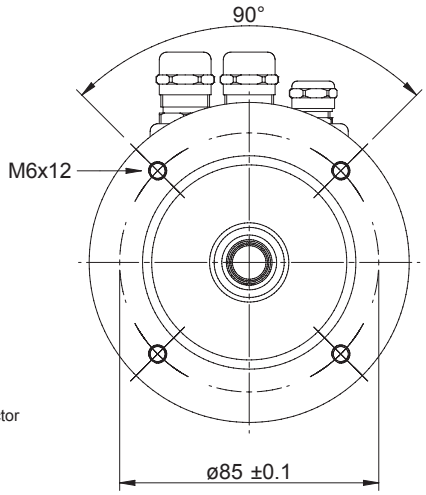


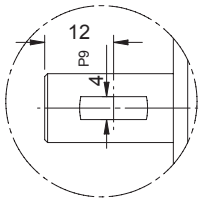
Model No. 66 with clamping flange and shaft with flat



Dimensions in mm





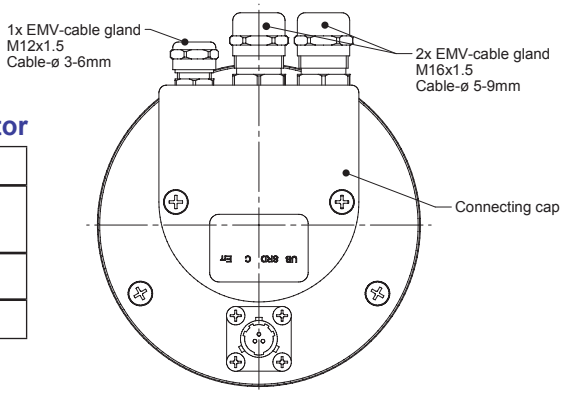


Detail A
2:1

Groove for woodruff key
4x 5 DIN 6888 Series A

Connection diagram heating connector

Pin	Connection
A	+ V_S = +24 Volt ±10% Io < 500 mA
B	- V_S = 0 Volt
C	n.c.



Connecting cap ZD-P3L4-23 (aluminium) / ZD-P3L4-27 (stainless steel)

The cap is listed as a separate item for ordering and delivery.
The cap can be separated from the encoder for setting purposes by removing two screws.